

**Standard Operating Procedure
Residential Well Sampling**

SOP: 11-1
Revision: 3*
Initial Date: 1/2/07
Last Revised: 02/06/07
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Prepared: Jeremy Berblinger

Review: Darren Brown

Approved: *Roger L. Olson*

Date Approved: 2/06/07

1.0 Overview and Application

This standard operating procedure (SOP) describes field procedures used for collection of groundwater samples from the Illinois River watershed (IRW) of eastern Oklahoma. Groundwater samples will be collected from up to fifty existing wells locations within the Oklahoma portion of the IRW. Locations within various potentially impacted areas and areas suspected to have minimal impact will be selected for sampling. Procedures for on site measurement of various water quality parameters such as temperature, conductivity, turbidity, pH, oxidation-reduction potential, and dissolved oxygen will are provided.

Application of poultry house waste to fields has been identified as a probable source of contamination in springs and river base flow. These observations indicate that the source of these waters (i.e., groundwater) is also contaminated. The extent and degree of potential groundwater impact is currently not known. This study will help identify the levels of potential environmental contaminants in the groundwater.

2.0 Sampling Methods Summary

At each sample location, field crews will obtain permission of property owners to sample wells at designated locations. Wells should be allowed to run for fifteen minutes before parameters are recorded and samples collected. Property owners must first sign an access agreement form and grant permission before sampling can take place. Samples will be collected in appropriate containers and shipped directly to the laboratories listed in Section 4.2.

2.1 Sampling Locations

Existing well information in northeast Oklahoma will be reviewed and compiled into a database. The purpose of this subtask is to provide locations where groundwater samples can be collected from existing wells. The data gathered from existing wells will be posted on maps to facilitate well selection.

Existing wells will be targeted with completion depths less than 150 feet in order to focus on groundwater most likely to be impacted by land application. Existing wells within various sub-

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watersheds having variable chicken densities will be selected. Existing wells within sub-watersheds having approximately the same chicken densities but at different distances from chicken houses or known application sites will also be selected.

2.2 Sample Types

Water samples will be grab samples. A grab sample is defined as a single aliquot from a specific location or depth at a given point in time. This type of sample represents a single value and can, in certain instances, be used as an alternative to analyzing a number of individual discrete samples and calculating an average value.

2.3 Data To Be Collected

At each sampling location, a variety of physical and water quality parameters will be assessed and recorded. The exact location of the sampling should be measured with a handheld GPS unit and recorded. Water quality parameters will be measured using an Oakton temperature, pH, conductivity multi-meters which will be calibrated and verified before and after each sampling event as described in Standard Operating Procedure 8-1: *Water Quality Meters*. At each sampling location the meter probe will be placed into the sample of the well water and a reading will be recorded for each of the following parameters:

- Temperature in degrees Celsius
- pH
- Specific conductance in micro-Siemens per cm

2.4 General Supplies

The following is a list of the minimum supplies needed for ground water sampling within the IRW:

- Temperature, pH, and conductivity multi-meters
- Sample bottles with labels
- Clear tape
- Coolers with ice
- De-ionized water
- Phosphate-free detergent
- Nitrile gloves
- Field Notebooks with water resistant paper
- Handheld GPS Unit, with extra batteries
- Digital camera with extra batteries
- Tools for minor equipment repairs

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- Drinking water

3.0 Sampling Procedures

Procedures for collecting the water samples may vary depending on the type of sample desired. In general, the following procedures should be employed.

- Obtain permission from land owner in the form of a signed access agreement form.
- Locate well, allow water to run for 15 minutes, if permitted by landowner/resident.
- After purging well, fill clean 5- gallon bucket with 1-2 gallons of sample water and submerge temperature/pH/conductivity probe. Wait for meter to stabilize and record readings in field notebook.
- Carefully fill the appropriate sample bottles with the sample water. Samples will typically be collected using (1) 1 gallon clean (unused) jug, (1) 500 ml sterile bottle for bacteria, and (1) 150 ml bottle for phosphorous parameters.
- Store the samples in a cooler with plenty of ice until shipment to appropriate laboratories.
- Bacteria samples will be shipped the same day to Environmental Microbiology Laboratory. Contact information is listed below.
- The phosphorous samples will be shipped the same day to Aquatic Research Inc.
- The 1 gallon jugs will be sent to the CDM Denver lab where parameters to be analyzed will be determined.

Contact information is provided in Section 4.2.

4.0 Sample Containers, Preservation Techniques, Quality Control

Periodically throughout the sampling, samples will be packed and shipped in coolers to one of several different analytical laboratories (contact information below) depending on analyses required (contact information below). Field control samples will be collected by the sampling team to determine whether data are of suitable quality. Control samples may include trip blanks or duplicates. Duplicates should be collected at least once for every twenty samples by filling additional sample containers while the well is still pumping. Decon blanks were not collected as the samples were collected directly from the tap or faucet and sampling equipment was not necessary.

4.1 Decontamination Procedures

To ensure that samples are not contaminated by equipment or containers, it is necessary to follow certain procedures for cleaning or decontaminating equipment. All sampling equipment which is in direct contact with the sample water must be cleaned between each sample collection. Equipment which must be decontaminated will include, but is not limited to: plastic

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5-gallon bucket, multi-meter probes, filtering apparatus, beakers or flasks, and volumetric measurement devices.

Procedures for decontamination are as follows:

- Rinse all surfaces with de-ionized or distilled water.
- Using a spray bottle, apply a layer of phosphate-free detergent to all surfaces.
- Rinse all surfaces again with de-ionized or distilled water until all detergent has been removed.
- If appropriate, rinse the sampling container with the collected water.

4.2 Laboratory Contact Information

The following is a list of contact information and shipping addresses for all analytical laboratories used for water samples from IRW Groundwater Sampling.

Environmental Microbiology Laboratory
1150 Bayhill Drive, Suite 100
San Bruno, CA 94066
Contact: Megan S. Tatreau, 858-268-2770
E-mail: mtatreau@emlab.com

CDM Denver Lab
2714 Walnut Street
Denver, CO 80205
303-308-2310
Contact: Todd Burgess
E-mail: burgesserte@cdm.com

Aquatic Research Inc
3927 Aurora Avenue North
Seattle, WA 98103
Contact: Steve Lazoff, 206-632-2715

5.0 Identifying information to be recorded on the sample label for groundwater well samples:

1. Alphanumeric identification of the well: This can be the State Well ID or the name of the current well owner. The prefix of GW will be placed in front of

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the Well ID to distinguish that the sample is a groundwater sample. Initially, no prefix was placed in front of the Well ID.

2. The following sample number is an example of the well sample collected from residential well 66783:

GW-66783

3. Samples sent to the analytical laboratory will have alphanumeric identification of the type of sample added to the end of the number:
 - a. Q = field duplicate.
 - b. E = laboratory QA/QC (extra volume)
4. Date of sample collection (only on chain-of-custody),
5. Time of sample collection (only on chain-of-custody),
6. Initials of the person collecting the sample (only on chain-of-custody).

6.0 Documentation

Bound field logbooks should be used for the maintenance of field records. All aspects of sample collection and handling as well as visual observations shall be documented in the field logbooks. Supplemental information may be documented on the field data sheets provided. All entries in field logbooks should be legibly recorded and contain accurate and inclusive documentation of an individual's project activities.

7.0 Additional Information

Other contact information:

Bert Fisher, PhD
Lithochimeia, Inc.
222 South Kenosha Ave.
Tulsa, OK 74120
Telephone: 918-382-9784

8.0 Revised Dates*

The following are other revision dates applicable to this SOP.

Revision 2 – February 5, 2007
Revision 1 – January 4, 2007

**Standard Operating Procedure
Direct Push Groundwater Sampling**

SOP: 11-2
Revision: 3*
Initial Date: 01/09/2007
Last Revised: 02/06/2007
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Prepared: Jeremy Berblinger

Review: Darren Brown

Approved: *Roger L. Olsen*

Date Approved: 2/06/07

1.0 Overview and Application

This standard operating procedure (SOP) describes field procedures used for collection of groundwater samples by direct push sampling methods from the Illinois River watershed (IRW) of eastern Oklahoma. Groundwater samples will be collected from approximately fifty locations within the Oklahoma portion of the IRW. Locations anticipated to have saturated unconsolidated sediments within various impacted areas will be selected for sampling. Procedures for on site measurement of various water quality parameters such as temperature, conductivity, pH, oxidation-reduction potential, and dissolved oxygen are provided.

Application of poultry house waste to fields has been identified as a probable source of contamination in springs and river base flow. These observations indicate that the source of these waters (i.e., groundwater) is also contaminated. The extent and degree of potential groundwater impact is currently not known. This study will help identify the levels of potential environmental contaminants in the groundwater.

2.0 Sampling Methods Summary

At each sample location, field crews will set up on staked locations that have been cleared of all utilities. Direct push technology will be used to collect groundwater samples from unconsolidated sediments. Probe rods will be advanced to bedrock or refusal. The screen will be exposed to the unconsolidated material and allow water, if present, to enter rods. Up to thirty minutes will be allotted for water to enter the probe rods. The depth to water will be checked and noted in the field book prior to sampling. The sample will be collected using ¼-inch poly-ethylene tubing fitted with a check valve. The tubing will be vertically manipulated to evacuate groundwater from the probe rods. The water will be transferred from the tubing directly into the appropriate sample containers.

2.1 Sampling Locations

Groundwater samples will be collected by direct push technology from saturated unconsolidated sediments within litter applied fields (if access is obtained) and along select public right-of-way (ROW) points throughout the basin.

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- Locations will be selected primarily within areas evaluated by a geologist as having the potential to have saturated unconsolidated sediments. Most of the saturated unconsolidated sediments in this watershed are likely to be predominantly comprised of alluvial material. Within Oklahoma, these locations are typically along developed creeks and rivers. The major creeks and rivers are typically within fracture zones, and are likely to receive groundwater contribution from both bedrock and saturated alluvium.
- Primary targeted areas are the Flint Creek drainage, Illinois River drainage, Ballard Creek drainage, Baron Fork drainage, and Caney Creek drainage. Where appropriate, locations with drainages entering Oklahoma from Arkansas will be selected.
- Preliminary sites will be visually inspected to determine whether saturated unconsolidated sediments may be present. Visual inspection will include observing bedrock outcroppings and the relative position of bedrock material to surface water elevation. If surface water is present below the elevation of the bedrock outcrops, there is low likelihood of having groundwater present within the unconsolidated material.
- Sites within the subpoenaed property will be evaluated for the potential to have saturated unconsolidated material.
- Sites along state and county right-of-ways (ROWs) will be evaluated as potential sampling locations. ROW sites must have sufficient access on shoulder to permit sampling.

2.2 Sample Types

Water samples will be grab samples. A grab sample is defined as a single aliquot from a specific location or depth at a given point in time. This type of sample represents a single value and can, in certain instances, be used as an alternative to analyzing a number of individual discrete samples and calculating an average value.

2.3 General Supplies

The following is a list of the minimum supplies needed for ground water sampling within the IRW:

- Sample bottles with labels
- Direct Push rig (typically a Geoprobe™ rig)
- 1000' roll of ¼-inch poly-ethylene tubing
- Check valve
- Clear tape
- Flagging tape, stakes, etc.
- Coolers with ice
- De-ionized water
- Phosphate-free detergent
- Nitrile gloves

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- Field Notebooks with water resistant paper
- Handheld GPS Unit, with extra batteries
- Digital camera with extra batteries
- Tools for minor equipment repairs
- Drinking water

3.0 Sampling Procedures

Procedures for collecting the water samples may vary depending on the type of sample desired. In general, the following procedures will be employed.

- Feed ¼ -inch poly-ethylene tubing, with check valve connected to the end, inside the probe rods until the bottom of the rods is encountered. Rapidly move the tubing up and down (approximately 1 foot) inside the rod until water can be seen near top of tubing. With the check valve properly functioning, water will enter the tubing each time it is lowered and the check valve will keep the water from leaving the tubing as the tubing is raised.
- Carefully fill the appropriate sample bottles with the sample water. Samples will typically be collected using (1) 1 gallon clean (unused) bottle, (1) 500 ml sterile bottle for bacteria, and (1) 125 ml plastic bottle for phosphorus analyses.
- Store the samples in a cooler with plenty of ice until shipment to appropriate laboratories.
- Bacteria samples will be shipped the same day to Environmental Microbiology Laboratory. Contact information is listed below.
- Phosphorus samples will be shipped the same day to Aquatic Research Inc. Contact information is listed below.
- The 1 gallon bottle will be sent to the CDM Denver lab where parameters to be analyzed will be determined. Contact information is listed below.

4.0 Sample Containers, Preservation Techniques, Quality Control

Periodically throughout the sampling, samples will be packed and shipped in coolers to one of several different analytical laboratories depending on analyses required (contact information below). Field control samples will be collected by the sampling team to determine whether data are of suitable quality. Control samples may include rinsate blanks and duplicates. Duplicates are samples that are collected by filling additional sample bottles while using the tubing and check valve to generate flow through the tubing. If enough water is present, duplicate samples should be collected at least once for every twenty samples.

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4.1 Decontamination Procedures

To ensure that samples are not contaminated by equipment or containers, it is necessary to follow certain procedures for cleaning or decontaminating equipment. All sampling equipment which is in direct contact with the sample water will be cleaned between each sample collection. Equipment to be decontaminated will include, but is not limited to: plastic 5-gallon bucket, multi-meter probes, filtering apparatus, beakers or flasks, and volumetric measurement devices. Probe rods and screens will also be decontaminated between sample locations. Downhole sample tubing will be disposed between sample locations.

Procedures for decontamination for small tools and sample equipment are as follows:

- Using a spray bottle, apply a layer of phosphate-free detergent to all surfaces.
- Rinse all surfaces again with de-ionized or distilled water until all detergent has been removed.

For larger equipment and probe rods, the following procedure will be used:

- Spray all surfaces with hot water pressure washer. (i.e., probe rods, screens and check valve)

Decontamination fluids will be discharged to the ground in the immediate vicinity of the decontamination activity. All solids, such as gloves and paper towels will be bagged and disposed in a dumpster serviced by a municipal waste disposal firm.

4.2 Laboratory Contact Information

The following is a list of contact information and shipping addresses for all analytical laboratories used for water samples from IRW Groundwater Sampling.

Aquatic Research Inc
3927 Aurora Avenue North
Seattle, WA 98103
Contact: Steve Lazoff, 206-632-2715

CDM Denver Lab
2714 Walnut Street
Denver, CO 80205
303-308-2310
Contact: Todd Burgess
E-mail: burgesserte@cdm.com

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Environmental Microbiology Laboratory
1150 Bayhill Drive, Suite 100
San Bruno, CA 94066
Contact: Megan S. Tatreau, 858-268-2770
e-mail: mtatreau@emlab.com

5.0 Documentation

Bound field logbooks should be used for the maintenance of field records. All aspects of sample collection and handling as well as visual observations will be documented in the field logbooks. Supplemental information may be documented on the field data sheets provided. All entries in field logbooks should be legibly recorded and contain accurate and inclusive documentation of an individual's project activities.

6.0 Additional Information

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Lithochimeia, Inc.
222 South Kenosha Ave.
Tulsa, OK 74120
Telephone: 918-382-9784

7.0 Revised Dates*

The following are other revision dates applicable to this SOP.

Revision 2 – January 22, 2007
Revision 1 – January 16, 2007